M. PHARM. – PHARMACOLOGY
COURSE STRUCTURE (w. e. f. 2011-12)

Course No.	Title	L(h)	T(h)	P(h)	C
I SEMESTER					
	THEORY				
MPS1101	Advanced Instrumental Analysis (AIA)	3	1	0	4
MPS1131	Biological Standardization and Pharmacological Screening (BSPS)	3	0	0	3
MPS1133	Molecular Pharmacology & Advanced Toxicology (MPAT)	3	0	0	3
	LAB				
MPS1112	Modern Analytical Techniques Lab	0	0	3	2
MPS1132	Preclinical Studies Lab	0	0	3	2
	BREADTH				
MMA1101	Applied Science: Biostatistics	3	0	0	3
	Breadth Paper	3	0	0	3
	Total	**15**	**1**	**6**	**20**
	Total Hours	**22**			
II SEMESTER					
	THEORY				
MPS2101	Biopharmaceutics & Pharmacokinetics	3	0	0	3
MPS2131	Clinical Pharmacology & Pharmacotherapeutics	3	0	0	3
MPS2133	Advanced Pharmacology	3	0	0	3
	ELECTIVE(ANY ONE)				
MPS2141 **MCR3101** **MPSE109**	Clinical Research – Ethics and Design Pharmacovigilance Clinical Pharmacy	3	0	0	3
	LAB				
MPS2132	Biochemical Pharmacology Lab	0	0	6	4
MPS2134	Isolated Tissue and Bioassay Lab	0	0	6	4
	Total	12	0	12	**20**
	Total Hours	**24**			
III SEMESTER					
MPS3131	THESIS	-	-	-	**15**
IV SEMESTER					
MPS4131	THESIS	-	-	-	**20**

Total Credit - 75

Note:
L: Lecture; T: Tutorial; P: Practical; C: Credit
MPS: M. Pharm. Pharmaceutical Sciences Core
MPSE: M. Pharm. Pharmaceutical Sciences ELECTIVE
MMA: Mathematics
MCR: M.S. Pharmaceutical Sciences Core

M. PHARM – I SEMESTER

MPS1101 : ADVANCED INSTRUMENTAL ANALYSIS (AIA) (4 CREDITS)

1. Analytical Application of Absorption Spectra: 3h
   Absorptiometric assay of Organic Compounds, Structural Analysis.
2. Infrared Spectrophotometry: 6h
   Qualitative uses; Interpretation of I.R. Spectra, Quantitative analysis**.**
3. NMR-Spectroscopy: 8h
   The NMR-Signal, Instrumentation practical consideration, chemical shift, spin-spin coupling, Structure elucidation, investigation of dynamic properties of molecules, quantitative analysis.
4. Mass Spectrometry: 8h
   Theory instrumentation, practical consideration, structure elucidation, detection of impurities, quantitative analysis, application to determination of structure, the gas chromatograph mass spectrometer combination.
5. Optical Rotatory Dispersion: 3h
   Terminology Plain Curves, Rotatory dispersion of ketones, The Axial Haloketone Rule, Octant Rule.
6. Recent trends in chromatography with reference to analysis of drugs and related substances: HPLC, UPLC, HPTLC , GC and hyphenated techniques(LC-MS/ LC-MS/MS).
   8h
7. Theory, Instrumentation and Applications of: 8h
   Thermogravimetric Analysis (TGA), Differential thermal analysis (DTA), Differential Scanning Calorimeter (DSC), X ray Diffraction(XRD).

BOOKS RECOMMENDED:

1. Practical Pharmaceutical Chemistry (part II) by Beckett and Stenlake.
2. Optical Rotatory Dispersion by C. D.jerassi (For ORD).
3. Indian Pharmaceutical (Biological & Microbiological Assay).
4. British Pharmaceutical (Biological & Microbiological Assay).
5. UV and Visible Spectroscopy, Chemical Application-C.N. R. Rao.
6. Spectrometric identification of organic compound- Silverstein.
7. Chemical application of IR spectroscopy – C.N.R. Rao.
8. Physical Methods of Organic Chemistry- Weissberger.
9. Interpretation of Mass Spectra of organic compounds-B. Kienicz, C. Djerassi.
10. Application of NMR Spectra to Organic Chemistry-Jackmann.
11. Instrumental Methods of Analysis- Willard.
12. Applications of Absorption spectroscopy of organic compounds – John R. Dyer.
13. Pharmaceutical Experiments on isolated preparations by the staff of the Department of Pharmacology, University of Edinburg.
14. Pharmacological Techniques in Drug evaluation, Vol. 1&2 by Peter E. Siegler, J.H. Meyer.
15. Lewis Pharmacology- James Crossland.
16. Fundamental of Experimental Pharmacology- M.N. Ghosh.
17. Indian Pharmacopoeia.
18. British Pharmacopoeia.
19. United States Pharmacopoeia .
20. Assay of Vitamins by Haskmi

MPS1131: BIOLOGICAL STANDARDIZATION & PHARMACOLOGICAL SCREENING (3 CREDITS)

1. Laboratory Animals 7h.
   a. Commonly used laboratory, transgenic and other genetically prone animal models (viz. nude mice SH rats etc.)
   b. Techniques of blood collection, anesthesia & euthanasia of experiment animals.
   c. Maintenance & breeding of laboratory animals.
   d. Regulation and ethics requirements.
   e. Guidelines & regulatory agencies – CPCSEA, OECD, FDA ICH, FHSA, EPA, EEC, WHO, etc.
   f. Importance of alternative experimental models, its advantages & disadvantages.

2. Principles of Biological Standardization 4h.
   a. Methods of biological assay, principles of biological assays with certain examples as per IP and BP.
   b. Development of new bioassay methods.

3. Immunoassay 5h
   a. General principles of immunoassay, Theoretical basis, Optimization of immunoassay, Heterogenous immunoassay system, Homogenous immuno system.
   b. Production of immunoassay reagent: Introduction, receptors or binders, unlabelled ligands Calibrators, Labelled ligands and receptor, Separation technique, buffers.
   c. Immunoassay Methods Evaluation: Protocol outline, objective & preparation, evaluation of precision, standard tracer, sensitivity, evaluation of accuracy, antibody characteristics, monitoring, reaction conditions, clinical evaluation.

4. Organization of screening for the Pharmacological activity of new substances with emphasis on evaluation using in-vivo, in-vitro, ex-vivo, in-situ, in silico and other possible animal alternative models. 18h.

   a. General Principles & safety pharmacology procedure.
   b. CVS Pharmacology – Antihypertensive, Anti arrhythmics, Vasodilators, disentail.
   c. CNS Pharmacology – behavioral & muscle co-ordination, CNS stimulants, anti-epileptics, Nootropics.
   d. Drugs for Neurodegenerative diseases, like parkinsonism, Alzheimers, multiple sclerosis.
   e. Drugs acting on ANS.
   f. Respiratory Pharmacology – Anti-asthmatics, COPD, Anti-allergic & Mucoactives.
   g. Reproductive Pharmacology – Aphrodisiacs & antifertility agents.
   h. Analgesics, anti-inflammatory & antipyretics.
   i. G.I.T. – Anti-ulcer, anti-emetics, anti-diarrhoeal & laxatives.
   j. Anti-cancer agents.
   k. Metabolic disorders like anti-diabetics, anti-hyperlipidemic, anti-obesity, hepatoprotective.
   l. Models in drug absorption & metabolism.
   m. Immuno Pharmacology – specific (cell & hormonal mediated) & non-specific methods.
   n. Screening of free radical scavenging activity.
   o. Acute, Sub-acute & Chronic toxicity test.

5. Clinical pharmacology and pharmacodynamics: clinical study design, documentation, presentation and interpretation 2h

6. Clinical trials: definition, phase I – IV studies, design documentation, presentation and interpretation, statistical analysis of clinical data, factorial design, guidelines as per Indian and other regulatory authorities. 5h
7. Importance of alternative experiment models, its advantages & disadvantages. 2h

BOOKS RECOMMENDED :

1. Biological standardization by J.H. Burn, D.J. Finney & L.G. Goodwin.
2. I.P. & B.P.
3. Screening Methods in Pharmacology by R.A. Turner. Vol. I & II Academic Press, New York and London.
4. Evaluation of drug activities by Laurence & Bacherce.
5. Methods in Pharmacology by Arnold Schwartz.
6. Selected topics on Experiment Pharmacology by Issha G. Kamat, Dadkar, N.K. & Seth, UK.
7. Fundamental of Experimental Pharmacology, by M..N. Ghosh. Scientific Book Agency, Calcutta.
8. Pharmacological Experiment on intact preparation by Churchill Livingstone
9. Drug Discovery and evaluation by H.G. Vogel & W.H. Vogel. Springer Verlag, Berlin Heideleberg.
10. Animal Model in Toxicology by Shayne Cox Gad & Christopher P, Chengelis.
11. Principles & Methods of Toxicology by Hays.
12. CRC Handbook of Toxicology by Derelako & Hollinger.
13. Handbook of Experimental Pharmacology by S.S. Kulkarni. Vallabh Prakashen, Delhi.
14. Pharmacological Experiments on Intact and Isolated preparations, Edinburgh University Pharmacology Staff, Livingstone.
15. Goodman and Gilman's The Pharmacological basis of Therapeutics – Ninth edition, Editors. A. G. Gilman, J. G. Hardman, L. E. Limbiod, P. B. Melineff, R. W. Rudder, Macmillan Publishing Co. Inc. – Latest edition.
16. Clinical Pharmacotherapecutics, edited by Kamalesh Kohli, Elsevier Publication.

MPS1133 MOLECULAR PHARMACOLOGY & ADVANCED TOXICOLOGY (MPAT) (3 CREDITS)

1. Molecular Pharmacology 6hrs

a. The study of the molecular, biochemical, genetic and cellular mechanisms of action of drugs or endogenous signaling molecules.

b. Analysis of cellular signal transduction pathways for drugs and endogenous molecules.

c. Study of genetic variations in drug action and drug metabolism including cellular receptors, signal transduction proteins, cellular adhesion molecules, ion channels, drug abuse, second messenger molecules, metal toxicity, oxidant toxicity and drug metabolism.

2. Essential of Toxicology: 6 hrs.

   a. Physicochemical, Biochemical & genetic basis of toxicity, principles of toxicokinetics, mutagenesis & carcinogensis.
   b. Behavioural, Inhalation, Cellular & Sub cellular toxicity hypersensitivity, immune response, range finding test.
   c. Acute, Sub-acute & Chromic toxicity test.

3. Molecular Mechanism of Toxicity: 8 h
   Cellular dysfunction, Cell destruction, Cellular responses to injury
   Switch points between cell survival and apoptosis or necrosis
   Receptor mediated toxicity, Mechanism of cell death, calcium mediated toxicity, excitatory amino acid toxicity, NO toxicity and steroid hormone induced toxicity. Mechanism of chemical toxicity, Oxidative stress, Necrosis and significance of toxicity evaluation.
4. Toxic Response to foreign compounds 6h
   Direct toxic action: tissue lesions
   Pharmacological, Physiological and biochemical effects
   Teratogenesis
   Immunotoxicity
   Genotoxicity
5. Organ Toxicity 8 h
   Liver toxicity
   Kidney toxicity
   Respiratory toxicity
6. Carcinogenicity of drugs 5h
   Benign &Malignant tumors and their classification
   Mechanism of Carcinogenicity
   Assessment of the potential Carcinogenicity of drug.
7. Pharmacovigilance 3h

Reference:

1. Pharmaceutical Toxicology, edited by Gerard Mulder and Lennert Deanokr ULLA, Ph.P.

2. Principles of Biochemical Toxicology, John Timbrell ed 3rd ed.

3. Invitro Toxicity Testing.
4. Principles of Clinical Toxicology by Gossel & Brieker Raven Press.
5. General and Applied Toxicology by Bryan Ballantyne.
6. Text Book of toxicology Vol. I, II & III by O.P. Gupta
7. Toxicology - The basic science of poisons, international edition, Curtis D.Klaassen, 6th edition.
8. Toxicology – Principles and Applications, Raymond J.M.Niesink, John de.Vries, Mannfred A. Hollinger.
9. Oxford Text Book of Clinical Pharmacology and Drug Therapy, 3rd edition, Graham-Smith D. and Aronson J., Oxford University Press.
10. Text Book of Therapeutics: Drug and Disease Management. 7th Edition. Editors: Eric T. Herfindal and Dick R. Gourley, Williams and Wilkins, 2000
11. Davidson's Principles and Practice of Medicine, Eds. Christopher R.W.Edwards and Lan A.D.Bouchier ELBS with Churchill Livingstone, Edinburgh. LatestEdition.
12. Applied Therapeutics: The Clinical Use or Drugs Eds. Brian S.Katcher, Lioyd Yee Young, Marry Anne Koda-Kimble, Applied Therapeutics Inc. Spokane. Latest Edition.
13. Pathology & Therapeutics for Pharmacists. Greene, R.J & Harris, N.D. (1993). The Pharmaceutical Press.

MPS1112 MODERN ANALYTICAL TECHNIQUES LAB (2 Credits)

1. Determination of λmax. Of given sample using Spectrocolorimeter and validity of Lambert-Beer's Law.
2. Assay of Paracetamol Tablets using UV-Spectrophotometer.
3. Assay of Quinine Sulphate using UV-Spectrophotometer.
4. Assay of Nimesulide Tablets using UV-Spectrophotometer.
5. Assay of Riboflavin Tablets using Fluorescence Spectrophotometer.
6. Assay of Quinine Sulphate tablets using Fluorescence Spectrophotometer.
7. Determination of of Na^+ & K^+ using Flame Photometer.
8. Determination of Dextrose in Dextrose Injection using Polarimeter.
9. Determination of α-Amino Acid using pH-Meter.
10. Assay of Paracetamol in the sample using HPLC.
11. Demonstration of functional groups of the given samples I.R.Spectrophotometer.
12. Assay of Paracetamol in the sample using HPTLC.

MPS1132: PRECLINICAL STUDIES LAB (2 Credits)

1. Experimental Techniques to evaluate the various classes of drugs (in vivo studies) (at least 10-12 experiments).

   A. Drugs acting on GIT: - General screening methods of ulcer activity, intestinal motility, & anti-diarrhoeal
   B. Experiments on toxicology: - Oral, Parentral & skin acute toxicity test.
   C. Experiments on Analgesic & Antipyretic drugs.

Reference:

1. Biological standardization by J.H. Burn, D.J. Finney & L.G. Goodwin.
2. I.P. & B.P.
3. Screening Methods in Pharmacology – R.A. Turner.
4. Evaluation of drug activities by Laurance & Bacherce.
5. Methods in Pharmacology by Arnold Schwartz.
6. Selected topics on Experiment Pharmacology by Issha G. Kamat, Dadkar, N.K. & Seth, UK.
7. Fundamental of Experiment Pharmacology – M.N. Gl.
8. Pharmacological Experiment on intact preparation by Churchill Livingstone
9. Drug Discovery & Evaluation by Vogel HG.
10. Animal Model in Toxicology by Shayne Cox Gad & Christopher P, Chengelis.
11. Principles & Methods of Toxicology by Hays.
12. CRC Handbook of Toxicology by Derelako & Hollinger.

M.PHARM (II SEMESTER)
MPS2101: BIOPHARMACEUTICS & PHARMACOKINETICS (3 CREDITS)

I. BIOPHARMACEUTICAL CONSIDERATIONS IN DRUG PRODUCT DESIGN

1. **Factors Influencing Dosage Form Design**:
   - i) Rate-Limiting step in Drug Absorption
   - ii) Biopharmaceutical Aspects
   - iii) Patient Considerations
   - iv) Manufacturing Considerations
2. **Factors Influencing Drug Dissolution/Bioavailability:**
   - i) Physico-Chemical
   - ii) Pharmaceutical, and
   - iii) Formulation
3. **Rate –Limiting Step in Bioavailability:**
   - i) Disintegration – in vitro, in -vivo
   - ii) *in-vitro* Dissolution Testing
   - iii) *in-vitro* Dissolution to *in-vivo* Absorption correlation including its failure.
   - iv) Dissolution Testing in lieu of Bioavailability Studies.

II. BIOAVAILABILITY & BIOEQUIVALENCE

1. Definitions of Related Terms (*UG)
2. Purpose of Bioavailability Studies (* UG)
3. Relative & Absolute Bioavailability
4. Bioavailability Assessment
5. Bioequivalence Studies
   - i) Design of Study ii) Statistical Evaluation
6. Waiver of *in-vivo* Bioavailability & Bioequivalence
7. Ranking of Drugs and Several Formulations of the Drug

III. DRUG DISTRIBUTION & ELIMINATION

1. Physiological Factors Influencing Drug Distribution
2. Protein Binding
3. Volume of Distribution
4. Physiological Approach to Drug Elimination
5. Clearance Concepts
6. Dependence of Drug Elimination Kinetics on Clearance & Distribution

IV. PHARMACOKINETICS (based on Plasma & Urinary Excretion Data of Intact Drug)

1. Compartmental Approach:
   - i) One Compartmental Model
   - ii) Two Compartmental Model

2. Nonlinear (Dose Dependent) Pharmacokinetics:

i) Michaelis-Menten Concept
ii) Pharmacokinetics of Drugs under Such Situations
(one compartment model – single dose):
a) Intravenous Administration, and
b) First-Order Absorption
iii) Time-Dependent Pharmacokinetics
iv) Nonlinear Pharmacokinetics due to Protein Binding
v) Pitfalls in Pharmacokinetic Modelling

BOOKS RECOMMENDED

1. Wagner : Biopharmaceutics & Relevant Pharmacokinetics, Drug Intelligence Publication, 1971.
2. Swarbrick:Current Concepts in Pharmaceutical Sciences (Biopharmaceutics), Lea & Febiger, 1970.
3. Swarbrick: Current Concepts in Pharmaceutical Sciences (Dosage Form Design & Bioavailability), Lea & Febiger, 1973.
4. Niazi: Text Book of Biopharmaceutics & Clinical Pharmacokinetics, Appleton Century Crofts, 1979.
5. Evans et al.: Applied Pharmacokinetics (Principles of Therapeutic Drug Monitoring), Applied Therapeutics, 1980.
6. Gibaldi & Perrier: Pharmacokinetics, 2nd ed. (Revised & Expanded), Marcel Dekker (series in Drugs & Pharmaceutical Sciences – vol. 15), 1982.
7. Gibaldi: Biopharmaceutics & Clinical Pharmacokinetics, 3rd ed., Lea & Febiger, 1984.
8. Ritschel: Graphical Approach to Clinical Pharmacokinetics, 2nd ed., Prous Publishers, 1984.
9. Notari: Biopharmaceutics & Clinical Pharmacokinetics (an introduction), 4th ed. (Revised & Expanded), Marcel Dekker, 1987.
10. Rowland & Tozer : Clinical Pharmacokinetics (Concepts & Applications), 3rd ed., Lea & Febiger – Waverly, 1995.
11. Macheras et al: Biopharmaceutics of Orally Administered Drug, Ellis Horwood (series in Pharmaceutical Technology), 1995.
12. Welling & Tse: Pharmacokinetics (Regulatory, Industrial, Academic Perspectives), 2nd ed., Marcel Dekker (series in Drugs & Pharmaceutical Sciences-vol. 67), 1995.
13. Shargel & Yu: Applied Biopharmaceutics & Pharmacokinetics, 4th ed., Appleton & Lange, 1999.
14. Ratkowsky et al. : "Cross-Over Experiments: Design, Analysis & Applications," Marcel Dekker (series in Statistics: Textbooks and Monograph- Vol. 135)

MPS2131: CLINICAL PHARMACOLOGY & PHARMACOTHERAPEUTICS
(3 CREDITS)

Pathophysiology & applied Pharmacotherapeutic management of diseases associated with following system / diseases.

1. Nervous System 6 h

Pain and Pain Management, Pathophysiology to inflammation and repair, Pain pathways, Anaesthesia and Neuromuscular block
Epilepsy, Parkinsonism, schizophrenia, depression, migraine, Alzheimer's disease

2. Cardiovascular System 9h

Hypertension, Congestive cardiac failure, Ischemic heart disease (Angina, Myocardial infarction), Arrhythmias, Hyperlipidemias, atherosclerosis, Endocarditis, Thromboembolic disorder.
Haemostasis, Anaemia, Blood Substituents, Drug induced haematological disorders.

3. Respiratory System 4 h

Pulmonary function tests, bronchial asthma, Chronic obstructive airways diseases, Drug induced pulmonary diseases.

4. Renal & Endocrine System 11 h

Diuretic therapy, Potasium depletion, Hyperkalaemia, Acute Renal failure, Chronic renal failure, Drug induced renal diseases.
Adrenal corticoids, antagonists, Thyroid hormones & antithyroid drugs, Diabetes Mellitus, thyroid and parathyroid diseases, Hormone replacement therapy,

5. Gastrointestinal System 4 h

Ulcer diseases, Inflammatory Bowel Diseases, Hepatitis, cirrhosis, Jaundice, Diarrhoeas & Constipation,

6. Bone and joint disorders 4 h

Osteoporosis, rheumatoid arthritis, Osteoarthritis, gout, Paget's diseases of bones. Geriatric, Paediatric & Perinatal Pharmacology.

7. Neoplastic disorders & infections 6h

Acute leukemias, Hodgkins disease and carcinoma of breast etc.
Various infectious diseases including Tuberculosis, urinary tract infections, enteric infections, upper respiratory tract infections, sexually transmitted diseases and AIDS.

References:

1. Clinical Pharmacology by P.N. Bennet & M. J. Brown eds. 9th edn., Churchill Livingstone.
2. Clinical Pharmacy and Therapeutics – Eric Herfindal, Williams and Wilkins Publication.
3. Pathologic basis of diseases – Robins SL, W.B. Sunders Publicaton.
4. Davidson's Principle and Practice of Medicine, Eds. Christopher R. W., Edwards & Ian A.D. Boucher ELBS with Cdnorchill Living stone. Edinburgh. Latest Edition.
5. Harrisons Principles of Internal Medicine. Medical Toxicology (Ellen Horns).
6. Oxford Text Book of Clinical Pharmacology and Drug Therapy, 3rd edition, Graham-Smith D. and Aronson J., Oxford University Press

7. Principles of Pharmacology, the Pathophysiologic Basis of Drug Therapy,Lippincott, Williams & Wilkins.
8. CRC desk reference of Clinical Pharmacology, Manuchair Ebadi.
9. Oxford Text Book of Pharmaceutical Medicine, 4th edition, John P. Griffin, John O'Grady.
10. Oxford Text Book of Medicine, 4th edition, David A. Warrell, Timothy M. Cox, John D. Firth.
11. Pathology & Therapeutics for Pharmacists. Russel. J. Greene and Normal F.Harris. Chapman & Hall, London/ Glasgow/ Madras.
12. Text Book of Therapeutics: Drug and Disease Management. 7th Edition. Editors: Eric T. Herfindal and Dick R. Gourley, Williams and Wilkins, 2000

MPS2133: ADVANCED PHARMACOLOGY (3 CREDITS)

1. Emerging Trends & Recent Advances in : 8 h
   a. Receptor and G-protein
   b. Cyclic nucleolides
   c. Ion channel regulators
   d. Gene therapy

2. Neurohumora; transmission in central and Automatic Nervous System
   Mechanism of Neurohumoral transmission in CNS and ANS, Adrenergic, Choline, dopamnergic Serotoninergic, Histaminergic, GABA ergic and excifatory amino acid receptors and their subtypes. 10 h

3. Autacoid Pharmacology 10 h
   Eicosanoids (Prostaglandins, leukotriences, thromboxanes and related compounds) Nitric oxide oxygen free radicals, Role of Endothliam in vascular function, cytokines, opioid autacoids, Cox – 2 selective Inhibitors.

4. CVS function: 5 h
   Renin Angiotens in system, Applications in clinical cardiology
   Current perspective in Lipid Lowering Strategies.

5. CNS Disorders 5 h
   Neuroprotective role of Melatonin
   Parkinson's and Alzheimer's disease: current and future therapies.

6. G.I.T. Disorders 2h
   Treatment of GIT disease with melatonin.

7. Chemotherapy of Microbial disease 4 h
   Recent development of chemotherapy agents, Antiretroviral therapy for HIV infected Adults & Adolescents.

References:

1. Clinical Pharmacotherapeutics, ed. By Kamlesh Koshi, Elsevier Publication.
2. Principles of Pharmacology ed. By Paul L. Musan Chapman & Hall
3. Harrisons Principles of Internal Medicine. Medical Toxicology (Ellen Horns)
4. Davidson's Principle and Practice of Medicine, Eds. Christopher R. W., Edwards & Ian A.D. Boucher ELBS with Cdnorchill Living stone. Edinburgh. Latest Edition.
5. Principles of Pharmacology, the Pathophysiologic Basis of Drug Therapy,Lippincott, Williams & Wilkins.
6. Drug Interaction Facts, 2003. David S. Tatro

MPS2141: CLINICAL RESEARCH – ETHICS & DESIGN (3 CREDITS)

1. Clinical Research – Introduction, History, Present & Future Scenario 2h
2. Drug Development – Discovery, Screening, Formulation, Preclinical, Various Phases (Phase I to Phase IV) of Clinical Study, Clinical & Product Registration 3h
3. BA/BE Studies 1h
4. Investigational New Drug & New Drug Application 1h
5. Regulations – Schedule Y, 21CFR part 11, 50, 54, 56, 310, 312, Drug Registration: Introduction, U.S regulation, Japan regulation, U.K regulation, Indian regulation, Ethnic Insures in drug Registration. 4h
6. Study Participants – Sponsor, Investigator, Volunteer, Contract Research Organization, Data Safety & Monitoring Board 3h
7. Ethics – Principles & Practices --- History, Ethical Principles, Clinical Trial Regulations, Declaration of Helsinki, Ethics Committee, Informed Consent, Investigator's Responsibilities, Vulnerable populations 4h
8. Study Setup – Feasibility assessment, Site selection, Budget proposal 2h
9. Study Monitoring – Monitoring Responsibilities: Type of monitoring visits, Site Initiation, Interim Monitoring, Site close out, monitoring activities, Monitoring methods, Problem solving, Writing monitoring reports 8h
10. Investigational Product Management – Accountability, Distribution 2h
11. Study Design & Planning – Design, Study Protocol, Case Report Form, Quality of Life, Study Plan, Study Flow Chart, Investigator Selection, Clinical Trial Application 5h
12. Organization – Contracts & Agreements, Liability & Insurance, Financial Disclosure, Clinical Trial Committees, Logistics & Clinical Laboratory 3h
13. Study Conduct – Essential Documents, Subject Recruitment, Randomization & Blinding, Investigational Product Management, Clinical Trial Supplies 3h
14. Safety Reporting – Adverse Events, Serious Adverse Events, Adverse Drug Reactions, Patient Care in Clinical Research, Pharmacovigilance 2h
15. Study Report – Interpretation, Report & Retention of data/report 2h

Books Recommended

1. Principal and practice of Pharmaceutical Medicine edited by Andrew j Fleteher. Lionel D Edwards, Anthony W Fox. Peter Stonier Published by John Wiley & sons Ltd.
2. Clinical Pharmacotherapeutics- edited by Kamalesh Kholi. Elsevier Publication.
3. Statistical Methods for Clinical Trials, by Mark X Norleans, Marcel and Dekker, Inc, New York, 2001.

MCR3101: PHARMACOVIGILANCE (3 CREDITS)

1. **Pharmacovigilance –**

i) Drug related problems in health care

Types and mechanisms of ADRs, Risk factors for ADRs, Drug – drug interactions, Other causes of drug related problems, Drugs in pregnancy and lactation, Management of patients affected by ADRs, Medication errors 5h

ii) Clinical manifestations of ADRs 5h

Drug related diseases affecting different organ systems (Brief Overview since covered in Clinical Pharmacology)

iii) Spontaneous reporting 5h

Organization, Setting up and running a PhV centre, Patient reporting, Managing individual case report forms, Terminologies, Feed back to reporters, Case assessment, Signal analysis and follow up, Root cause analysis of medication errors

iv) Epidemiological Methods 5h

Drug utilization studies, Cohort event monitoring, Cohort studies, Case control studies, Longitudinal databases of patient records

v) Collection and management of safety data during clinical trials: 5h

Need for good quality safety information, Definition of good safety information, Differing regulations concerning safety data collection requirements, Designing a system to collect good quality information

vi) Post-marketing drug safety: Differences in clinical and post-marketing drug safety 4h

vii). Reporting to the Regulatory Authorities: 5h

Individual case safety reports, Periodic safety update reports, Answering queries from regulatory authorities, Updating product labelling – emphasis on safety changes, Safety reporting requirements, Safety report sources, Follow up of safety reports, Electronic safety reporting – Oracle & other software program available, Safety file retentions

viii) Global pharmacovigilance and safety standards 3h

- Background and introduction to pharmacovigilance
- The WHO and safety reporting
- CIOMS – function and purpose
- ICH – composition and guidelines
- MedRA

ix) Understanding signals and benefit-risk determinations 3h

- Definition of a signal
- Type of signal
- Who should be involved in signal detection process?
- Conducting signal detection in clinical and post-marketing surveillance
- Defining the signal in relation to risk/benefit
- Definitions of risk/benefit – FDA and EU perspective
- Risk/benefit assessments – who does this and where does the information go?

- Safety assessments and risk/benefit – frequency and reporting
- Changes in risk/benefit – how to manage and review existing profile

x) Standard operating procedures (SOPs) in relation to pharmacovigilance 3h

- Types of SOPs required
- Production and sign off of SOPs
- SOP maintenance
- SOP training

xi) The role of the qualified person (QP) 3h

- Contract versus permanent.
- Essential attributes of the QP
- The duties of the QP
- What the QP must do
- Internal audits of the company pharmacovigilance activities

xii) Audit

- Contracting out pharmacovigilance 3h
- Preparation for a regulatory inspection
- Scope of the pharmacovigilance inspection
- Conduct of the pharmacovigilance inspection
- The pharmacovigilance inspection report
- When things go wrong
- Corrective actions following a pharmacovigilance inspection

Books

1. Pharmacovigilance (2nd Edition) – Ronald D. Mann & Elizabeth B. Andrews, John Wiley & Sons
2. Pharmacovigilance from A to Z - Barton L. Cobert & Pierre Biron, Blackwell Science
3. Good Pharmacovigilance Practice – MHRA
4. Manual of Drug Safety and Pharmacovigilance – Barton L. Cobert, Jones & Bartlett Publishers
5. Dictionary of Pharmacovigilance – Amer Alghabban, Pahrmaceutical Press
6. An Introduction to Pharmacovigilance – Waller, Patrick; John Wiley & Sons
7. Pharmacovigilance (2nd Edition) – Ronald D. Mann & Elizabeth B. Andrews, John Wiley & Sons
8. Pharmacovigilance from A to Z - Barton L. Cobert & Pierre Biron, Blackwell Science
9. Good Pharmacovigilance Practice – MHRA
10. Manual of Drug Safety and Pharmacovigilance – Barton L. Cobert, Jones & Bartlett Publishers
11. Dictionary of Pharmacovigilance – Amer Alghabban, Pahrmaceutical Press
12. An Introduction to Pharmacovigilance – Waller, Patrick; John Wiley & Sons

MPSE109: CLINICAL PHARMACY (3 CREDITS)

1. Introduction to Clinical Pharmacy. 10h

Clinical laboratory tests used in the evaluation of disease states, and interpretation of tests results.
Haematological, Liver function, Renal function, Tests associated with Cardiac disorders, Fluid and electrolyte balance, Common test in urine, Sputum, faeces, CSF.
Identifying the Pathogen and selection of appropriate microbial therapy.
Drug interference with diagnostic tests, mechanism and interpretation.

2. Patient communication in Clinical Pharmacy Practice: The patient case history, its structure and use in evaluation of drug therapy. 4h

3. Prescription auditing and review. 8h

Drug Therapy Monitoring: Application to therapeutic drug monitoring (TDM) Pharmacist interventions (Interpretation of drug concentration data) of Theophylline, Gentamicin, Lithium, Carbamazapine, Phenobarbitone, Primidone, Valproic acid, Vigabatrin, Cyclosporin etc.

4. ADR and ADR monitoring, Management and reporting of drug interactions and adverse drug reactions. 4h
5. General Nutrition: 8h

General Nutrition guideline, Specific Nutritional considerations (Pregnancy, Diabetes Mellitus, patient with high blood pressure, Geriatric population, Obesity). Nutritional and their status in clinical medicine.

6. Drug information system: Introduction to information resources available, Drugs and Poisons Information, Design of literature searches. Development of a drug and poison information database. Critical evaluation of drug information and literature, Emergency treatment of Poison. 6h

7. Pharmacoepidemiology, Pharmacovigilance, Pharmacoeconomics: Types of Health Economic Evaluations. Decision analysis Technique. 4h

Wherever possible Discussion should be made with case studies.

REFERENCES **:**

1. Text Book of Therapeutics Drug & Disease Management VII ed. Eric T. Herfindale., Dick R. Gourley ed.
2. Clinical Pharmacy & Therapeutics Edt. By Roger Walker and Clive Edwards.
3. Relevant Review articles from recent medical & pharmaceutical journals.

MPS2132: BIOCHEMICAL PHARMACOLOGY LAB (4 CREDITS)

1. Determination of LD_{50} value.
2. Estimation of AST activity in serum.
3. Estimation of ALT activity in serum.
4. Estimation of ALP level in serum.
5. Estimation of Glucose level in serum.
6. Estimation of Cholesterol level in serum.
7. Estimation of Urea in serum.
8. Estimation of Urea in urine.
9. Estimation of Uric acid in serum.
10. Estimation of Uric acid in urine.
11. Estimation of Creatinine in serum.
12. Estimation of Creatinine in urine.
13. Estimation of SOD activity.
14. Estimation of Catalase activity.
15. Estimation of GSH levels.
16. Estimation of DPPH radical scavenging activity.
17. Isolation of DNA from Blood
18. Estimation of Lactate dehydrogenase in serum

Reference:

1. Biological standardization by J.H. Burn, D.J. Finney & L.G. Goodwin.
2. I.P. & B.P.
3. Screening Methods in Pharmacology – R.A. Turner.
4. Evaluation of drug activities by Laurance & Bacherce.
5. Methods in Pharmacology by Arnold Schwartz.
6. Selected topics on Experiment Pharmacology by Issha G. Kamat, Dadkar, N.K. & Seth, UK.
7. Fundamental of Experiment Pharmacology – M.N. Gl.
8. Pharmacological Experiment on intact preparation by Churchill Livingstone
9. Drug Discovery & Evaluation by Vogel HG.
10. Animal Model in Toxicology by Shayne Cox Gad & Christopher P, Chengelis.
11. Principles & Methods of Toxicology by Hays.
12. CRC Handbook of Toxicology by Derelako & Hollinger.

MPS2134 ISOLATED TISUE AND BIOASSAY LAB (4 CREDITS)

Experiments on Isolated preparations

1. To calculate PA2 value of atropine using acetylcholine as an agonist employing rabbit intestine.
2. To calculate PA2 value of atropine using acetylcholine as an agonist employing guinea pig ileum.
3. To calculate PA2 value of d-tubocurarine using acetylcholine as an agonist employing frog rectus abdomens muscle.
4. To calculate PA2 value of diphenhydramine using histamine as an agonist employing guinea pig ileum / rabbit jejunum.
5. To calculate PA2 value of cyproheptadine using serotonin employing guinea pig ileum / rabbit jejunum.
6. To record the CRC of 5-HT using rat fundus strip preparation.
7. To record the CRC of noradrenaline using rat anococcygeus muscle preparation.
8. To record the CRC of acetylcholine and it's modification by using rat colon preparation.
9. To record the CRC of oxytocin using uterus preparation.
10. To record the concentration dependent contractile responses of phenylephrine on the isolated rat vas deference preparation.
11. To record the CRC of acetylcholine on the guinea pig tracheal chain.
12. To determine the strength of unknown solution of acetylcholine by 3-point / 4- point bioassay using rabbit intestine / guinea pig ileum. Calculate the test of significance.
13. To determine the strength of unknown solution of histamine by 3-point / 4-point assay method using rabbit intestine / guinea pig ileum. Calculate the test of significance.
14. To determine the strength of unknown solution of histamine by 3-point / 4-point assay method using rat uterus.

Cardiovascular System

15. To study the effect of drug on normal and hypodynamic frog heart.
16. To record the effect of acetylcholine and nor adrenaline on the blood pressure and electrocardiography of an anaesthetized rats.

*Results should be expressed with statistical analysis.

M. PHARM III SEMESTER (15 CREDITS)

MPS3131: Thesis :

- **Thesis Seminar**

M. PHARM IV SEMESTER (20 CREDITS)

MPS4131: Thesis :

- **Presentation, Submission and Viva-Voce**

BREADTH PAPERS

MMA1101: BIOSTATISTICS (3 Credits)

1. **Introduction:** 1h
   Relevance and the scope of Statistics.
   Difference between 'Descriptive' and 'Inferential' Statistics; Relationship between them

2. **Sampling Methods** 4h
   Introduction of sampling, probability and non probability sampling, sampling procedures – simple random, stratified, systematic, cluster and multistage sampling, concept of sampling distribution.

3. **Statistical Inference** 6h
   Statistical estimation – point and confidence interval estimations, Introduction of statistical hypothesis and testing, comparison of population mean with sample means, comparing two sample mans, comparison of population proportion with sample proportions, comparing two sample proportions, comparison of more than two samples, introduction of non parametric statistical tests.

4. **Correlation and linear regression** 6h
   Introduction of correlation & regression concepts, estimation of correlation coefficient, regression coefficients, assumption of tests of hypothesis in linear regression, variance of sample estimates of the parameters, confidence intervals in regression analysis, non linear regressions, weighted and transformations in regression analysis, application of linear regressions - standard curves in drug analysis and drug stability studies, analysis of covariance.

5. **Concepts of Inferential Statistics** 4h
   Basics of Statistical Inference
   Sampling distribution
   Estimation – Point estimation, Interval estimation
   Parameter, Statistic, Concept of a hypothesis, Research Hypothesis, Null Hypothesis, Level of Significance, Comparison of means of two samples, Comparison of sample proportion with population proportion, Comparison of two sample proportions,
   Degrees of Freedom, Critical Value, Table value, Type I and Type II errors, Rules for rejection & acceptance of Null Hypothesis, Standard Error

6. **Inferential Statistics - Parametric Test**: 4h
   't' test – Comparison of sample mean with the population mean, Comparison of means of two independent samples, Comparison of two correlated samples
   'Z' test – different applications
   Annova – one way annova: 'F' test

7. **Quality control:**
   Introduction, control charts, acceptance sampling and operating characteristic curves, statistical procedures in Assay.Department, establishing in-house limits, some statistical aspects of quality and the "Barr Decision".
8. **Inferential Statistics - Non-parametric test**: 2h

Chi square test- Testing of goodness of fit, testing of independence, Test of homogeneity; Wilcoxon signed rank test; McNemar test

9. **Computer Applications & Practicals:** 2h
   Introduction of statistical software – SPSS with practical exercises

BOOKS RECOMMENDED:

1. Statistical issues in Drug Development by Stephen Senn, 1997, published by John Wiley and Sons Inc.
2. Practical and Clinical Applications 3rd Edn. Sandord Bolton, 1997 Marcel Dekkar Inc, Newyork.
3. Non parametric statistics for Behavioral Sciences by Sidney Siegel; 1956, McGraw Hills, New Delhi.
4. Design and Analysis of Bioavailability and Bioequivalence Studies – 2nd Edn. By Shein-Chung Chow and Jen-Pei Liu, 2000, Marcel Dekkar Inc, Newyork.
5. Computer Applications and Practicals: Introduction of softwares – SPSS/SAS and practical exercises.

Text Books

1. Pharmaceutical Statistics

MPS1113 BASIC APPROACHES IN DRUG DISCOVERY AND DEVELOPMENT
(3 CREDITS)

1. **Drug design –** Introduction**,** Definition, Rational,
   - Drug discovery & development, Definition, outline, achievements in the field of Pharmaceuticals & Medicinals.
   - Parameters involved in drug design, Physicochemical, Ionization, Hydrogen, bonding, Chelation, surface active agents Redoxpotential
   - Drug distribution: Oral, Systemic, Protein binding, Tissue depots.

2. **Receptors and drug receptor theories-**
   - Drug target binding forces – Electrostatic, Hydrophobic, Hydrogen bonding, Vanderwaals forces.
   - Drug receptor, interaction – Molecular biology of receptors – Protein coupled, Ion channel linked receptors, Nuclearreceptors, GPCR,.
   - Receptorial theories – Occupancy, theory, Rate theory, Induced fit theory, Macromolecular perturbation theory

3. **Isosterism & bioisosterism-**
   - Concepts of isosterism in drug design
   - Classical and non classical isosterism
   - Application of bioisosterism
   - Basic approaches in QSAR – Hansch equation, Free Wilson Model, Topliss Tree, Craig plot.

4. **Metabolite antagonism & drug design, Definition, Historical development-**
   - Wood fields antimetabolite theory
   - Mechanism based enzyme inhibition
   - Transition state analogs

5. **Concepts of drug discovery in Natural products** –
   Natural Leads : its identification and optimization using CADD techniques with few case studies.

6. **Basic concepts of chemoinformatics** –
   - Introduction to chemoinformatics
   - Molecular file formats and their conversions: smiles, smirks & smarts
   - Database search: sub structure search and similarity search

7. **Basic concepts of ADMET –**
   Introduction, General principles of ADMET & basic approaches in drug discovery & development.

BOOKS RECOMMENDED :

1. Manfred E. Wolff and Burger's, Medicinal Chemistry and Drug Discovery- Vol.1, Principles and Practice, Vth Ed, John Wiely & Sons.
2. E.J. Ariens; Drug Design, Academic Press, New York.
3. Progress in Medicinal Chemistry, Series by Ellis & Wert.
4. Wilson & Gisvolds – Text book of organic medicinal and pharmaceutical chemistry, 10^{th} Edition, 1998.
5. Receptor based drug design, by P. Leff, Marcel Dekker, New York, 1998.
6. Paul's charifson – Practical application of computer Aided drug design – Marcel Dekker – 1997.
7. The Organic Chemistry of Drug design and Drug Action - R.B.Silverman – Academic Press – 1992.
8. Exploring QSAR – Fundamental and applications in Chemistry and Biology by Carowari Hansch and Albert Leo, ACS, Washington DC – 1995.
9. Alan L. Harney - Advanced in drug discovery techniques.
10. Alfred Burger – Text Book of medicinal chemistry Vol. 1 & Vol. 2.
11. William O. Foye – Principles of Medicinal Chemistry Varghese Publishing House, Bombay – 3^{rd} Edition, 1989.
12. Ellis & Wert – Progress in Medicinal Chemistry – Academic Press, New York.
13. Chemistry of Alkaloids by S.W. Pelletier
14. Alkaloids by Manske.
15. Physiology by Dieter Hess.
16. Alkaloids by Fieser and Fieser.
17. Organic Chemistry by I.L. Finar Vol. II.
18. Chemistry of Natural Products by K.W. Bentley.
19. Synthesis of Aromatic Compounds by Ulrich Weiss & J. Michael Edwards.

Journals.

1. Phytochemistry
2. Planta Medica
3. Phytotherapy Research, Fitoterapia etc.
4. Journal of Medicinal Chemistry
5. Journal of Pharmaceutical Sciences.
6. Journal of Chem. Informatics & Computer Sc.
7. Drug Discovery today.
8. Journal of Computer Aided Molecular Design.